Field of the invention

The present invention relates to a procedure and a telecommunication system which enhances utilizing mobile telephone services in non-mobile telecommunication networks.

Background of the invention

There is known a technology of using one and the same personal telephone number recognizable in different telecommunications networks. For example, EP 0738093 A2 (to TELIA AB), which is incorporated herein by reference, describes the technology where one telephone number is associated with a subscriber in various different communications networks. A condition for using this personal number is a central network node located at or being in communication with the mentioned different networks, preferably PSTN, ISDN, GSM or other mobile networks such as NMT (Nordic Mobile Telephony). The central network node does not influence network functions, numbering schemes and terminals in these networks. When a call is directed to a subscriber associated with any of the mentioned telecommunications network or utilizing a cordless access system, the call (independent of which telecommunications network it emanates) is connected to this central network node which converts the received personal number to the specific number corresponding to the communications network at which the subscriber has registered himself/herself. Upon that conversion, the network node connects the call to the current access point which corresponds to the specific number.

Also, there is known a US patent 6,301,474 (to Openwave Technologies Inc.) which is incorporated hereby by reference, describing

a mobility extended telecommunication application. The technology comprises an integrated wireless and wirelined network with central control, which has a programmed interface to translate between the different protocols of the wireless and the wirelined networks to allow for automatic redirection of a new incoming call, that is about to be established, between a telephone device of the wireless network and a telephone device of the wireline network.

The services proposed in the above patent publications are quite advanced. However, every user who intensively uses the phone , often encounters the situation when a conversation starts while using a fixed or cordless phone but, since the user must leave the premises, the conversation has to be stopped and, upon redialing, to be continued from a mobile phone. The users are also familiar with an opposite situation, when a communication session starts at a mobile phone and after a period of time could have been continued at a fixed or cordless phone (e.g. while obtaining a higher quality of service and/or while using more comfortable appliances at the premises), but the cumbersome operation of disconnecting and re-connecting prevents the user from making that switch.

20

Summary of the invention

The objects of the present invention, among which resolving the problems outlined above, will be explained as the description of the invention proceeds.

25 By an embodiment of the present invention there is provided a method for supporting re-routing, during a single communication session, from a mobile device (e.g. a cellular telephone and the like) associated with a mobile communications network to a non-mobile device (e.g. a

desk telephone, a cordless telephone and the like, a computer, etc.) associated with a non-mobile communications network, or vice versa,.

The method comprises:

providing an edge node device that is operatively associated with both said mobile network, and said non-mobile network;

determining that both said mobile and non-mobile devices are located within a geographical proximity required to enable re-routing of a communication session being in progress on one of said devices, to be held via the other device;

at said edge node device, re-routing the communication session that is currently in progress and routed to one of said mobile and non-mobile devices, to the other of said mobile and non-mobile devices.

In practice, the rerouting step can be performed as follows:
if the communication session is currently in progress and routed to said mobile device via a current communication path terminating with a suitable section of said mobile network, rerouting said session to said non-mobile device via the same communication path wherein the termination portion is replaced with a section of the non-mobile communications network;
if the communication session is currently in progress and routed to said non-mobile device via a current communication path terminating with a suitable section of said non-mobile network, rerouting said session to said mobile device via the same communication path wherein the termination portion is replaced with a section of the non-mobile communications network.

Preferably, the edge node should support at least one communications protocol operative at the mobile network and at least one communications protocol operative at the non-mobile network.

The method further supposes connecting the edge node with the mobile network so as to allow exchanging digital signals with a control mobile unit of the mobile network (for example, with a radio network controller, RNC, of a base station of a cellular network, positioned close to the edge node – **OK?).**

It should be noted that each type of service including voice, transmitted via a communication path during the communication session, should preferably be provided using digital formats. (**OK? Or must be digital?)**

In the simplest case, the communication session is a telephone call. However, both the mobile device and the non-mobile communication devices may provide not only voice sessions, but ensure fax transmissions, data communications, multimedia sessions. It means that the mobile communication device can be a personal computer having a cellular connection to internet, a mobile phone with the fax and internet functionality, etc.

By one embodiment, the mobile and non-mobile device have a common receiver adapted to be used as a non-mobile device when in proximity with a base part of a cordless phone (e.g. one that is adapted to operate in a Digital European Cordless Telecommunication -DECT - network), while said receiver is also adapted to be used as a mobile device when remote from the base part of the cordless phone**. (And can it be used as a mobile when in proximity with the base part?)**

In this embodiment, the step of determining the proximity can automatically be performed by the base part of the cordless phone. However, the step of determining may be performed differently in such a

cordless telephone device, i.e. similar to the manner described below with respect to fully separated mobile and non-mobile devices. **(OK?)**

(Do the receiver with the base, and the receiver as a cellular phone have different phone numbers?

If it is known to use a receiver of a cordless phone as a cellular device, doesn't it mean that rerouting of a session in progress is obvious (i.e., always takes place in such receivers when in proximity with the base)? Or the obvious thing is only routing of a new session to a suitable mode, similar to that in US 6,301,474?)

In another, preferred embodiment, the non-mobile device is a communication device associated with a non-mobile network (such as a cordless phone, a fixed digital (**only?**) telephone in a wireline network, a wireless phone/computer in a wireless network), and the mobile device is a cellular communication device (such as a cellular telephone fully separate from the non-mobile device) associated with the mobile (cellular) network.

In this case, the step of determining said proximity between the mobile and non-mobile devices is performed by a user during the communication session, the step of determining the proximity further comprises informing the edge node that the rerouting is requested, wherein said informing is initiated by the user.

The request of rerouting is preferably applied from the device presently engaged with the communication session and results in revealing (i.e., comprises implicitly or explicitly) information on the number of the other device to which the rerouting is requested. In one embodiment of the method, the edge node may store information on a group of non-mobile devices and mobile devices that are pair-wise entitled for rerouting communication sessions there-between. **(Can there**

the DSLAM to support protocol(s) of at least said mobile network; the hardware/software block comprising a unit capable of performing **(and/or controlling?)** transfer of a communication session in progress from the mobile communication device to a non-mobile communication device and/or vice versa. **(Must the card(s) be inserted in the edge node device only? I mean, is it the only possibility to allocate the hardware/software? Can it partially be located at the RNC?)**

In a preferred embodiment of the invention, the edge node device is operatively connected with the mobile network e.g., a cellular network, to exchange digital signals with a mobile (cellular) unit, e.g. a base station controller.

Further preferably, the connection is provided by wireline means. The cellular unit can, for example, be in the form of a Radio Network Controller (RNC) or IMS **(I...M...S...?).**

According to yet a further aspect of the invention, there is provided a system for supporting a communication session in a combined network, the system comprising

at least one edge node as described above,

at least one non-mobile communication network associated with at least one non-mobile communication device, and

at least one mobile communication network associated with at least one mobile communication device and at least one control mobile unit connected to and operative to establish digital communication with said edge node.

As will be appreciated by those skilled in the art, the non-mobile networks may implement connections to the subscribers by applying one or more various technologies that are currently in use for access networks. Examples of such technologies are POTS (in which case the

digital signal received at the edge node device is converted into an analogue POTS signal **(Can be?)**, and shall be forwarded to the non-mobile device as such), ATM (where the signal may be forwarded to the non-mobile device as a VoATM signal), DSL (where the signal may be forwarded to the non-mobile device as a VoDSL signal), IP (where the signal may be forwarded to the non-mobile device as a VoIP signal Can be??), Bluetooth, UWB, Wimax **(where the signal may be forwarded wireless to the non-mobile wireless phone ??),** and the like.

The non-mobile network may comprise a number of fixed communication devices, one or more cordless communication devices, some of them connected in parallel (for example, a simple desk telephone and a cordless telephone in parallel). In the present specification, the non-mobile network is usually a LAN serving an office, a house, an apartment or the like; it can also be a wireless LAN connected to the edge node by wireline means **(OK?)** .

Owing to the new functionality of the edge device, the non-mobile network actually becomes part of the mobile (cellular) network.

For example, when the communication session is transferred from a mobile device to a non-mobile communication device, the session continues to be transmitted via and supported by the cellular network, as it was made before switching to the non-mobile device, except for the terminating section of the non-mobile network.

Though the user continues using the mobile (cellular) service when switching to a non-mobile network phone, it can be cost effective to both the service providers and the users, due to providing/enjoying the new useful feature.

Brief description of the drawings

The invention will be further described with reference to the following non-limiting drawings, in which:

Fig. 1 is a pictorial representation of one particular example of a communications system implementing the proposed technology.

Fig. 2illustrates a slightly different implementation of the proposed system, using another version of a control plane **(OK?)** for the cellular network **(Actually, it is not essential to our present invention, how the communication session is held in the cellular network - via RNC or via IMS. Correct? If it brings additional advantages to our case, please explain)**

Figs. 3a and 3b are a schematic exemplary pictorial diagram and a schematic flow chart illustrating how a communication session in progress can be transferred from a mobile communication device to a non-mobile communication device.

Fig. 4a and 4b illustrate, in the similar manner, rerouting of a communication session in progress from a non-mobile communication device to a mobile communication device.

Detailed description of the preferred embodiments

Herein below is a list of acronyms (abbreviations) to be used in the detailed description of the drawings. Some of the important abbreviations are:

CPE (Customer Premises Equipment); RNC(Radio Network Controller); Wi-Fi *(wireless fixed?);* UE*(a mobile device?);*

IMS *(.....?)*,

Fig. 1 illustrates a pictorial diagram of a combined communications networks system. The system comprises a local area network LAN 10 which contains a first private non-mobile network 12 (say, a house network) comprising a cordless phone 14 and a cordless computer 16. Communication sessions to and from the private non-mobile network 12 pass through a CPE (Customer Premises Equipment) 15 located in the house. The LAN 10 also includes a second non-mobile network 18 **(OK?)** comprising one or more wireless communication devices, such as a computer 20 communicating via a wireless link to an antenna 22 of a wireless local loop system **(OK?)** . Both the CPE 15 and the antenna 22 are connected in a wireline manner (say, via DSL cables/fibers 21 and 23) to a DSLAM 24 of the LAN 10. The DSLAM 24 supports protocols of the non-mobile networks 12 and 18 and, being an edge node between different types of networks, also supports at least a protocol of a mobile communications network 40. Moreover, the DSLAM 24, connected by DSL cables to the private networks 12 and 18, is also connected to an RNC (Radio Network Controller) 42 and thus forms a part of the cellular network 40. In this drawing, the connection between the DSLAM and the RNC is via a wireline link 43. **(Does RNC reside in the closest to DSLAM base station of the mobile network 40 ?)**

The DSLAM 24 may additionally be connected to other types of networks (say, a fixed network 26 comprising an ATM and IP sub-networks), and therefore constitutes a border node between any pair of the networks associated with it.

According to the invention, the DSLAM 24 is an edge node between a mobile (cellular) network 40 and a non-mobile LAN 10 comprising the private networks 12 and 18. The edge node 24 has a functionality similar to that of a cellular base station ("Node B"). DSLAM 24 is

provided with software and/or hardware means implementing the mentioned functionality and allowing the rerouting during a single communication session according to the invention.

This "quasi" Node B functionality comprises identifying, allocating and serving at least pre-determined cellular telephone numbers, including various services which can be provided by cellular equipment. In a case of a common receiver serving both as a mobile device and as part of a non- mobile cordless device, the function of identifying and allocating the mobile device is performed via the base of the cordless device being in communication with the edge node. In other cases, these functions are performed based on the signaling received at the edge node from either a non-mobile device (directly), or the mobile device (via its closest cellular unit e.g., base station) whenever the rerouting is requested. Serving of the mobile devices is therefore performed by the edge node with the aid of the cellular unit interconnected with the edge node, upon interconnecting the mobile device to the cellular unit of the mobile network. Usually, the cellular unit is a cellular controller of a base station of the mobile network, being the closest to the edge node.

As has been mentioned, the combined network system further comprises, for example, a fixed network 26 with a routing junction 27. The routing junction 27 performs navigation of data incoming the fixed network 26, either to an ATM –based portion 28 of the fixed network 26 (i.e., the network operating in the format of Asynchronous Transfer Mode), or to an IP portion 30 (the network utilizing Internet Protocol), and vice versa. The cellular network 40 (say, using Asynchronous Transfer Mode - ATM format) may be further connected with networks of other types.

It means that communication sessions of interest may be established along a communication path via a number of different network sections,

but the communication path sections which will be changed in the process of rerouting according to the invention, are a) a non-mobile network section in the LAN 10 between a particular non-mobile device and the edge node 24 **(OK?),** and b) a mobile network section in the network 40 between a particular mobile device and a closest base station (not shown, but controlled by the RNC 42 interconnected with the edge node).

Fig. 2 illustrates how the combined network of Fig. 1 can be modified to comprise an integral control plane IMS 50 **(IP Multimedia Subsystem - OK? Interactive Management System?)** which serves, instead of the RNC 42, for connecting the edge node 24 with the mobile network 40 (and other component networks of the system?) . The IMS preferably comprises a SIP Proxy Server of Session Initiating Protocol for Real-time Transport Protocol (RTP). **(OK?) Please explain the advantages of using IMS with SIP proxy for our method, in comparison with RNC.**

Fig. 3a is a simplified exemplary pictorial diagram illustrating rerouting of a communication session, when in progress via a mobile device, to a non-mobile communication device. Fig. 3b illustrates a schematic flow chart of the case. When the presence of an active mobile device is identified by any means, a message (i.e., the rerouting request) can be sent through the mobile device to the closest base station of the mobile network (i.e., to its controller) and then to the edge node, notifying the latter about the presence of the active mobile device. That message may comprise the mobile device identification (e.g. its number). The non-mobile device, the mobile device, and/or the edge node can be pre-configured with one or more specified devices which can be "inter-

switched", so that only communication sessions that are held while using these specified devices, can be re-routed when needed. In the drawing, the initial communication path (dotted line) between a mobile device MD and its destination comprises a 1st terminal section of the cellular network, between the MD and the closest base station with RNC. Upon rerouting to a non-mobile device NMD, the communication path, instead of the 1st terminal section, comprises a 2nd terminal section in the non-mobile network, between the NMD, the DSLAM (edge node) and the base station.

10

Fig. 4a is a pictorial diagram showing an example of rerouting a call starting via a non-mobile communiation device, to a mobile communication device. Fig. 4b is a flow chart illustrating the process of rerouting according to Fig. 4a. As described above by one of the embodiments of the present invention, the edge node device is operatively connected with a mobile network, e.g. a cellular network. However, the edge node device may additionally be connected to other types of communication networks, for example to fixed ATM and/or IP networks, and may suitably support the required communication protocols. Preferably, the edge node device is capable of establishing a communication path between its non-mobile subscriber using a non-mobile device and his/her destination via: a non-mobile network section (a digital POTS or non-POTS wireline network section, a section using WiMax, Bluetooth, UWB technologies) possibly via a mobile network*, and/or any other network as a case may be (IP network, ATM network and the like. **(*Can the initial communication session from the non-mobile device be established without a mobile network?).** Suppose, a communication session is established using such a communication path.

Further, the edge node device is adapted, after establishing the communication session along this path, to re-route that communication session along a different path so that the session shall continue between the subscriber's destination and a mobile device that is specified to be used for that purpose. To do that, the user through the active non-mobile device may apply to the edge node with a rerouting request, and the edge node device, using its interconnection with the cellular controller, will initiate establishing a new communication path which will comprise, instead of the non-mobile network section, a mobile network section between the selected mobile device and a closest base station of the mobile network.

In both examples shown in Figs 3a and 4a, in the process of establishing the new communication path, the edge node performs a functionality similar to that of "node B" (or functionality of a base station of the mobile network), since while it cannot and does not behave as a base station itself, it is directly interconnected with a base station controller or the like and thus imitates the mentioned functionality. **(OK?)**

Claims:

1. A method of supporting a single communication session in a combined network comprising at least a non-mobile communication network and a mobile communication network, the method comprises re-routing, during the single communication session, from a mobile device associated with the mobile communications network to a non-mobile device associated with the non-mobile communications network, or vice versa.

2. The method according to Claim 1, comprising steps of:
providing an edge node device that is operatively associated with both said mobile network, and said non-mobile network;

determining that both said mobile and non-mobile devices are located within a geographical proximity required to enable re-routing of a communication session being in progress on one of said devices, to be held via the other device;

at said edge node device, performing the re-routing of the communication session that is currently in progress and routed to one of said mobile and non-mobile devices, to the other of said mobile and non-mobile devices.

3. The method according to Claim 1 or 2, wherein said rerouting is performed as follows:
if the communication session is currently in progress and routed to said mobile device via a current communication path terminating with a suitable section of said mobile network, rerouting said session to said non-mobile device via the same communication path wherein the

termination portion is replaced with a section of the non-mobile communications network;

if the communication session is currently in progress and routed to said non-mobile device via a current communication path terminating with a suitable section of said non-mobile network, rerouting said session to said mobile device via the same communication path wherein the termination portion is replaced with a section of the non-mobile communications network.

4. The method according to any one of the preceding claims, wherein the mobile and the non-mobile device comprise a common receiver adapted to be used as a non-mobile device when in proximity with a base part of a cordless phone, said receiver is also adapted to be used as a mobile device when remote from the base part of the cordless phone.

5. The method according to Claim 4, wherein the step of determining the proximity is automatically performed by the base part of the cordless phone.

6. The method according to any one of Claims 1 to 3, wherein the non-mobile device is a communication device associated with the non-mobile network, and the mobile device is a cellular communication device fully separate from said non-mobile device and associated with the mobile network.

7. The method according to any one of Claims 4 or 6, wherein the step of determining said proximity between the mobile and non-mobile devices is performed by a user during the communication session, the

step of determining the proximity further comprises informing the edge node that the rerouting is requested, said informing being initiated by the user.

8. 5 The method according to Claim 7, wherein the request of rerouting is performed from the device presently engaged with the communication session and results in revealing information on the number of the other device to which the rerouting is requested.

9. 10 The method according to any one of the preceding claims, wherein upon carrying the proximity determination step, a user of the device currently engaged in the communication session receives an indication that he/she may switch to the other device.

10.15 The method according to any one of the preceding claims 2 to 9, wherein the edge node is supporting at least one communications protocol operative at the mobile network and at least one communications protocol operative at the non-mobile network.

11.20 The method according to any one of Claims 2 to 10, wherein the edge node device is operatively connected with a mobile network and adapted to exchange digital signals with a control mobile unit.

12. An edge node device for supporting a communication session in a combined communications network, capable of supporting protocols of a non-mobile network and a mobile network respectively, and adapted to be operatively connected to one or more non-mobile devices of said non-mobile network and to a control mobile unit of said mobile network; the

edge node being operative to support rerouting of the communication session when in progress via a specified non-mobile device of the non-mobile network, to a specified mobile device of the mobile network, and/or vice versa.

13. The edge node device according to Claim 12, supporting said rerouting upon receiving information that said specified non-mobile device and said specified mobile device are in proximity to one another.

14. The edge node device according to Claim 12 or 13, comprising a DSLAM (Digital Signal Line Access Multiplexer) serving said non-mobile network by supporting at least one protocol of the non-mobile network, and being further equipped with a hardware/software block allowing the DSLAM to support at least one protocol of said mobile network; the hardware/software block being also capable of supporting said rerouting of a communication session in progress from the mobile communication device to the non-mobile communication device and/or vice versa.

15. The edge node device according to any one of Claims 12 to 14, capable of exchanging digital signals with said control mobile unit.

16. A system for supporting a communication session in a combined communications network, the system comprising at least one edge node device according to any one of Claims 12 to 15, and
at least one non-mobile communication network associated with at least one non-mobile communication device,

at least one mobile communication network associated with at least one mobile communication device,

and at least one control mobile unit connected to and operative to perform digital communication with said edge node.

5

17. The system according to Claim 16, wherein the edge node device is connected to the control mobile unit by wireline means.

18. The system according to Claim 16 or 17, wherein said mobile network is a cellular network, said control mobile unit is a Radio Network Controller (RNC) associated with a base station closest to said edge node device.

15

Cross Network Subscriber

Via RNC to R99 Core, with Mobility

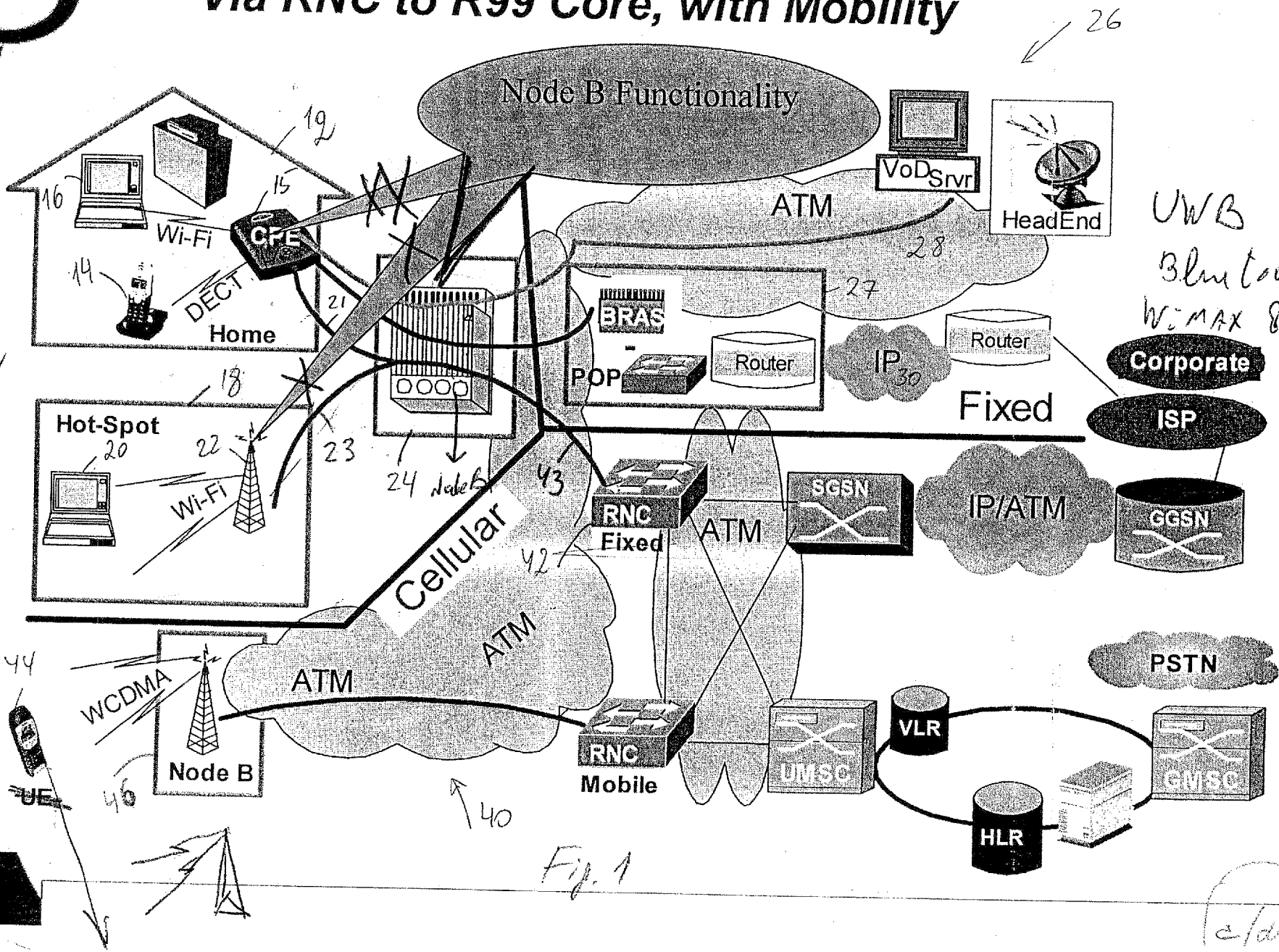


Fig. 1

Cross Network Subscriber

Via CSCF to R5/6 Core, with Mobility

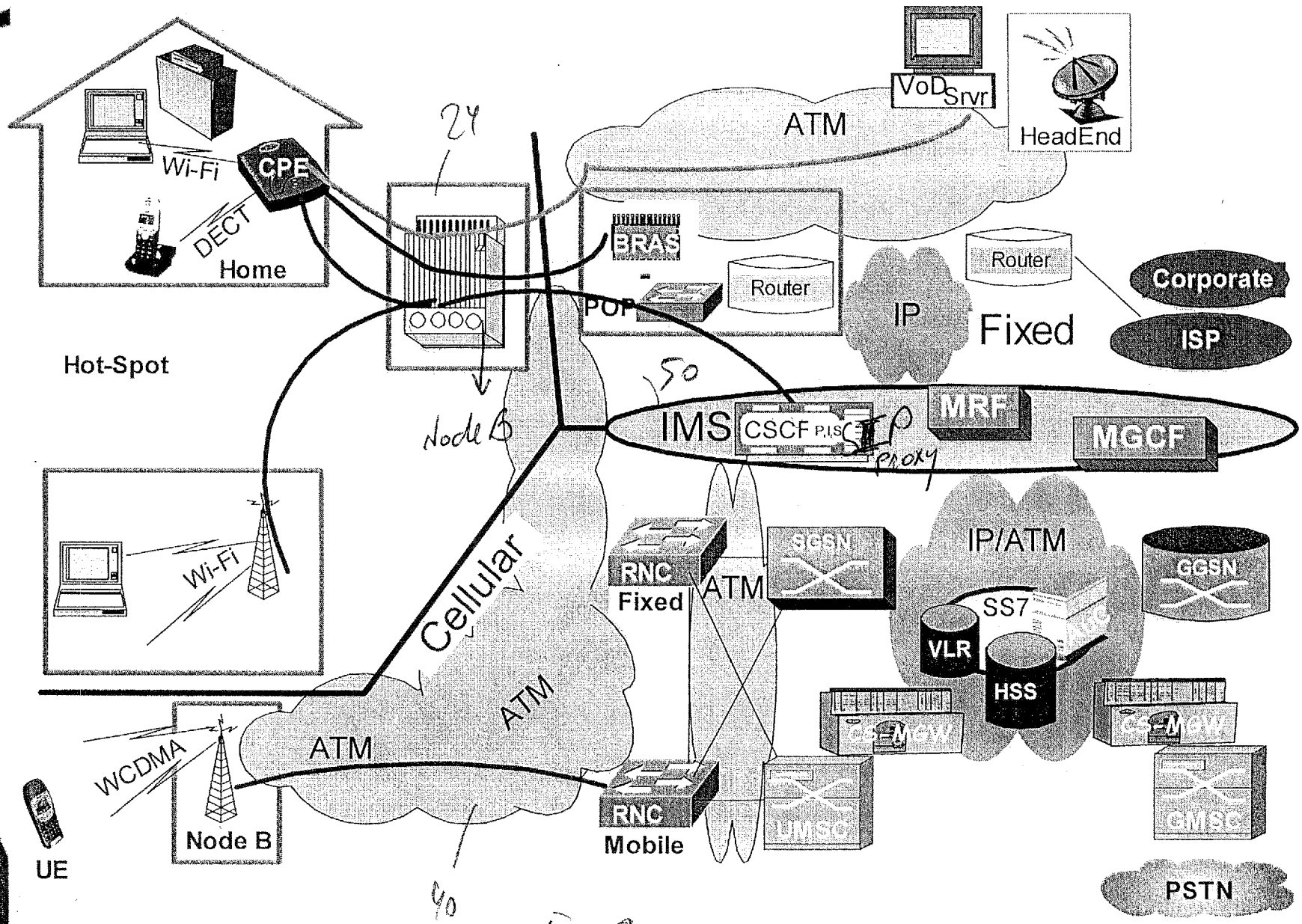
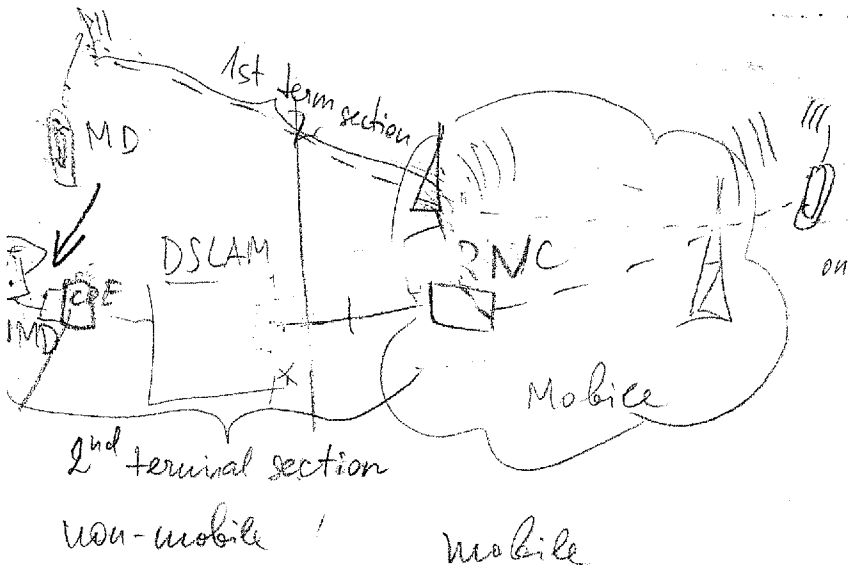


Fig. 2

Fig. 3A



Session is on a mobile device section is between a 1st terminal cellular unit and the mobile device

User determines that Mobile d. is in proximity to a suitable non-mobile d.

Applying from the mobile d. to a cellular unit for rerouting to the non-mobile d.

Informing the edge node by the cellular unit on the requested rerouting

Keeping the connection b. the cellular unit and the edge node

Establishing a new (2nd) terminal section between the non-mobile device and edge node interconnected to the cellular unit

Approval of the rerouting by the user and the edge node

Dropping the session via the 1st terminal section and routing it via the 2nd terminal ...

Fig. 3B

Session is on a non-mobile device the 1st terminal section is between the non-mobile d. and the edge node

User determines that a mobile d. is in proximity to the non-mobile device

Applying from the non-mobile to the edge node for rerouting to the mobile d.

Informing the cellular unit by the edge node about the requested rerouting

Keeping the connection between the cell. unit and the edge node

Establishing a new (2nd) terminal section between the mobile device and cellular unit interconnected with the edge node,

Approval of the rerouting

Dropp the 1st term section

Routing the session via the 2nd term section

Fig. 4c

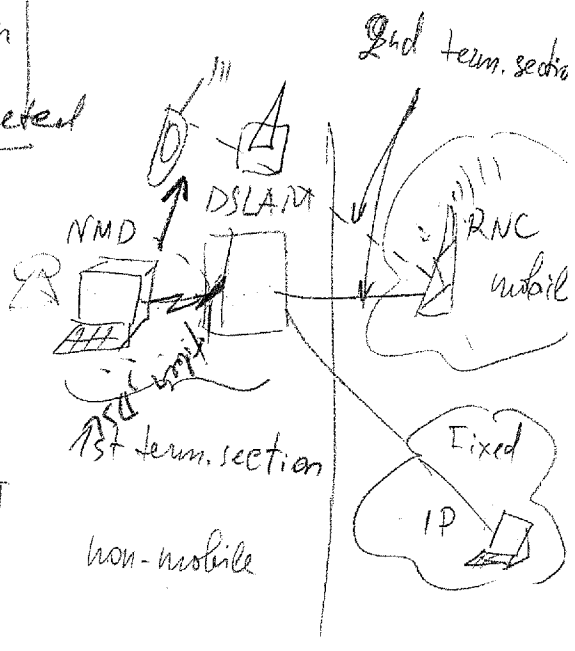


Fig. 11